Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Town Branch and Piper Creek[1]

Water Body Segment at a Glance:


State map showing location of watershed

County: Polk
Nearby City: Bolivar

Town Branch:
Water Body ID: 3822
Length of Classified Segment: 2.5 miles
Length of Impairment within Segment: 1.0 mile
Pollutant: Organic Sediment
Sources: Bolivar Wastewater Treatment Facility and Unknown

Piper Creek:
Water Body ID: 1444
Length of Classified Segment: 5.3 miles
Pollutant: Unknown
Source: Unknown

Scheduled for TMDL Development: Established by EPA 2010

Description of the Problem

Designated beneficial uses of Town Branch and Piper Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)
- Whole Body Contact Recreation – Category B

Use that is impaired

- Protection of Warm Water Aquatic Life

[1] The names of these streams and way they are listed on the 2008 303(d) List are somewhat different than what is in this Information Sheet, though the pollutants and sources are the same. The WBID 1444 had been applied to both Piper Creek and Town Branch and that "stream" was referred to as Town Branch of Piper Creek. This was corrected in the revision of the Water Quality Standards that went into effect Oct 30, 2009. Town Branch now has its own new WBID and the streams were measured more accurately.

Standards that apply

- Missouri's Water Quality Standards do not contain specific, numeric criteria for sediment. Therefore, the general (narrative) criteria apply. These may be found in 10 CSR 20-7.031(3)(A) and (C) where it states:
  - Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
  - Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.

Background information and water quality data

Town Branch of Piper Creek was placed on the 1994 303(d) list because it showed an accumulation of "objectionable solids" downstream from the Bolivar Wastewater Treatment Facility (WWTF). Organic sediment is organic (not sand or mineral) material, like algae or sewage sludge. When this material settles onto the streambed, it smothers natural substrates (materials in the streambed), aquatic invertebrate animals (like crayfish and water insects) and fish eggs.

Three studies by the department of deposition of sediment in Town Branch and Piper Creek began in 2003. Two of the studies characterize the impacts to the stream related to fine sediment deposition and organic solids. One was completed in 2004 and the other in 2006 (data are shown in the Table 1).

Table 1. Results from the "Sediment" Studies, 2004-2006
Quantitative Measurement of Sediment and Percent Fine Sediment Deposition (PFSD)

Analyte	Mean: Town Branch of Piper Cr.		t	Probability of a Greater t value
	Above WWTP	Below WWTP		
BOD	131.33	470.54	1.765	0.0505
TSS	4050	23046	2.072	0.0302
VSS	449.25	2300	3.16	0.0038
PFSD	22.81	92.78	15.402	0

Analyte	Mean: Piper Creek		t	Probability of a Greater t value
	Above Town Br.	Below Town Br.		
BOD	204.5	237.5	0.323	0.3747
TSS	21445	6407	3.295	0.0027
VSS	2282	848.7	2.552	0.0111
PFSD	69.44	72.79	0.493	0.3117

Notes: BOD = biochemical oxygen demand; TSS = total suspended solids; VSS = volatile suspended solids

All four types of sediment measurements made showed higher levels of fine sediments in Town Branch downstream of the Bolivar WWTP than upstream. The higher levels of VSS and BOD indicate that there was significantly more organic sediment and oxygen demanding sediments downstream of the WWTP, suggesting that occasional discharge of sewage sludge is occurring. While the area of the stream bottom covered with fine sediment was essentially the same on the upstream and downstream portions of Piper Creek, quantitative measurements indicated significantly deeper deposits of fine sediment in the portion of Piper Creek upstream of Town Branch.

The portion of the studies examining the aquatic community (the bioassessment) indicates it is impaired due to the WWTF. The scores in Table 2 are stream condition index (SCI) scores that rate the numbers and diversity and pollution tolerance of invertebrates living in the creek. Streams with scores of 14 or lower are considered impaired. The sediment studies also reported heavy growth of algae both up and downstream of the plant, indicating the WWTF is not the only source of the impairment. There are unknown pollutants from unknown sources.

Table 2. Aquatic Invertebrate Community Scores from the Bioassessment

Location	WBID	Fall 2003	Spring 2004
Piper Cr.1.1 mi. above Town Br.	U	10	10
Town Br. 0.1 mi. above Bolivar WWTP	1444	14	8
Town Br. 0.3 mi. below Bolivar WWTP	1444	10	10
Piper Cr. 1.5 mi. below Bolivar WWTP	1444	14	12

Therefore, besides the WWTF, the TMDL identifies other possible sources of nutrients (the likely cause of the excess algal growth). These would be nonpoint sources (from stormwater runoff in general) and could include fertilizer from lawns and agricultural lands or leaking septic systems, among many other things. The bioassessment study recommends the use of best management practices inside and outside of the Bolivar city limits to help control nonpoint source pollution.

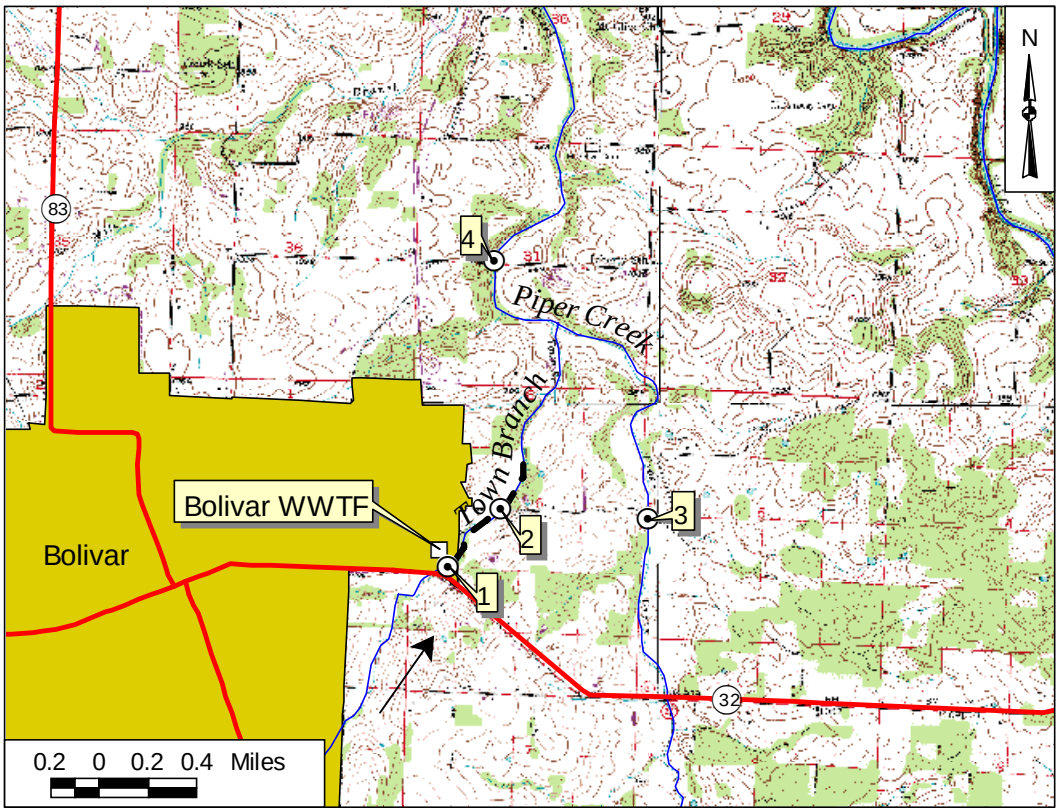
In 2005, the local community within the Piper Creek watershed organized the Bolivar Community Watershed Improvement Group, or BCWIG, to find ways to remediate the problem(s). Some of the actions they have taken so far include removing the city compost pile from the stream's flood plain and having the creek tested for bacteria. High bacteria levels were found upstream, as well as downstream, of the WWTF. The group has also formulated a monitoring plan for Town Branch and Piper Creek, which they are using to collect more data so they can more accurately identify sources of pollutants.

In July and August of 2009, U.S. Environmental Protection Agency, or EPA, collected additional data at the same four sites as in previous department studies (see map below) to be able to set a target for the nonpoint sources and to address the unknown pollutants. Data they collected, in addition to the department studies, suggested the following pollutants that may be leading to the impairment of aquatic life. The pollutants include:

- Nutrients (total nitrogen and total phosphorus) from nonpoint and point sources that may contribute to excessive algae growth above and below the Bolivar WWTF;
- Sediment (total suspended solids) from nonpoint and point sources that may contribute to sedimentation and poor substrate habitat and;
- Low dissolved oxygen caused by decaying organic solids, as measured by carbonaceous biochemical oxygen demand, or $CBOD_5$, high consumption of oxygen from decaying matter on the streambed below the Bolivar WWTF and physical factors associated with low reaeration rates.

EPA established the Piper Creek and Town Branch TMDL for these pollutants on Nov. 1, 2010.

Impaired Segment of Town Branch of Piper Creek in Polk County, Missouri



Impaired Segment Direction of Flow

Site Index

1-Town Branch 0.1 mi. above Bolivar WWTF outfall
2-Town Branch 0.5 mile below Bolivar WWTF
3- Piper Creek. upstream of Town Branch at 435th Rd.
4- Piper Creek. 1.7 mile below Bolivar WWTF at 425th Road

For more information call or write:

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